HARDWOOD VEGETATIVE PROPAGATION

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In the last few years there has been increased interest in asexual propagation of forest hardwood species. To a large degree this is the result of realization of the need for hardwood tree improvement to increase the quality of the hardwood supply. To establish hardwood clonal orchards economically, successful methods of asexual propagation must be developed.

Until recently, asexual propagation of hardwood species was confined to selecting original trees for fruit or nut production and budding or grafting onto seedlings. When the budding or grafting gave consistently poor results, the trees were rejected; only the trees which could be grafted easily were left. This method of tree selection is of rather questionable value when the final crop is wood fiber because we might lose our best potential growers. The point we must keep in mind is that ease of asexual propagation varies both species by species and tree by tree.

I would like to discuss my subject under three topics of asexual propagation: budding, grafting, and rooting scions.

BUDDING

This is the method which has been used for reproducing most of the nut-producing clones and some fruit trees. The budding is done generally by four methods: T-bud, inverted T-bud, patch bud, and ring bud. Most budding is done in July and early August, but some patch budding is done in May or early June.

I have had poor success in budding yellow-poplar with the T-bud method. Dave Funk (5) has had good success using this method on yellow-poplar and Johnny Hatmaker (7) has had fair to good success.

If you are interested in trying budding methods, I suggest you work not only with the forest species but also with a species of fruit tree. This will help you develop a good budding technique.

GRAFTING

There are numerous **methods** which can be used in grafting. The method I used successfully on oaks and yellow-poplar was the top cleft graft.

The grafting is done when leaves of the understock, same species as scions, are about 1 inch long and the scion material is dormant. The scions are collected prior to bud swelling, in late February or early March. (The collection time will vary depending on the geographic area.)

The scion material should be about 1 year old and 6 inches long. The cut surfaces of the scions and understock should be about 2 inches long. The scion and the understock are placed together so that cambium will match on at least one side, and the graft is wrapped with grafting rubber. The area, including the rubber, is then coated with grafting wax or anhydrous lanolin to seal off all cut surfaces from the air. In work I did with yellow-poplar, one clone had 60 percent survival with anhydrous lanolin and zero percent survival with grafting wax; four other clones I used showed no difference between the two coatings. All work was done within a 4-hour period. At this same time, I grafted scions from a Frasier magnolia onto two yellow-poplar seedlings. Both grafts lived and grew until the middle of August before they died.

A method used by Johnny Hatmaker (7) is to bench graft using a whip technique. This graft is made near the root collar in the late winter or early spring, with both the understock and the scions dormant. After completing the graft, the union is wrapped with raffia and the ramet is placed in the hot bed and covered with sawdust, except for the top buds. The ramets are left there until growth starts and then are potted or placed in line-out beds.

The hot bed is about 3 feet wide and as long as needed. A heat source of 70-75° F is installed in the bottom and covered with 10-12 inches of damp (not wet) sawdust. The bed should be located in a cool area to keep the tops cool and the bottoms warm, which helps callus to form at the union prior to growth.

Dr. 0. F. Milikan (9) suggests fall grafting of oaks; this is the method used in eastern Europe with oak and walnut. He found that butternuts and Carpathian walnut must be grafted early or the buds will break and leaf out.

The grafting is done from mid-October through November, when buds are at full rest; the cambium on the understock matches the cambium on the scion. The ramets are then packed in sterilized damp sawdust at 80° F for about 3 weeks before being lined out for the winter. They should not be put into a room with excessive heat, generally over 80° F, because this might cause the buds to break and growth to start. The Europeans have had good success using this method.

Another method which has been used successfully is a nurse-seed grafting technique (1,6) using large seeds, such as acorns. The seed is allowed to germinate in a medium, and the shoot is allowed to grow until it is about 2 inches above the medium. It is then cut off just above the cotyledons and a slit about 1 inch long made from the cut-off point down into the root section. The scion material should be dormant wood about 2 inches long and the same diameter as the root section. The scion is cut in a wedge shape and inserted into the cut, and the union is wrapped with untreated cotton wrapping twine. The ramets can then be potted in moist soil with the graft union completely covered. It should be placed in shade at a temperature suitable for plant growth.

A modification of this method used by Allen Beck (1) is to cut off the shoot and leave a 2-inch root and cut the root to form a wedge. The scion, about 3 inches long, is slit up from the bottom about 1 1/2 inches and inserted over the wedge-shaped section of root and wrapped with a rubber strip. The ramet is then placed in a propagating bench and allowed to grow. This method is a nurse-root graft rather than a normal graft.

ROOTING OF SCIONS

This method holds promise in some forest trees, but may have to be used in conjunction with other methods.

McAlpine (8) has been able to root yellow-poplar cuttings from epicormic sprouts. These sprouts can be produced by various methods: cutting down the tree to produce stump sprouts, putting partial girdles on the trees, or grafting scions onto understock and allowing it to grow for a year and then cutting the scion back to produce sprouts.

The sprouts are collected in about June when they have 5-10 leaves, which should not be allowed to wilt, and the branches are cut into segments having three leaves. The basal end is dipped into Hormodin No. 3 and placed in a mist bed. After the cuttings have rooted, they should be transferred to a shaded nursery bed.

The propagation bed should have bottom heat in areas which have cool nights. The mist cycle is 4 seconds each minute during daylight hours. The bed should be protected so there is a good mist pattern over the entire bed.

Farmer and Hall (4) have had success in rooting black cherry cuttings taken from ramets grafted with mature scion wood. The grafts were pruned back and allowed to sprout and sprouts were used for the cutting material. The apical cuttings, about 6 inches long, were taken when they were partially lignified. The leaves were trimmed back to 1/2

their original area, and the basal end was treated with 0.8% IBA-talc dip and inserted in the propagation bed. Bottom heat was used with a mist cycle of 10 seconds every 3 minutes during daylight hours. The best success was obtained with April cuttings.

Another method of rooting scions was used by Farmer (3) to root cuttings from 2-year-old black walnut seedlings. He placed the potted seedlings in a dark, warm room to allow the shoots to grow until they were about 8 inches long, at which time some of the shoots were girdled at their bases with copper wire. After a few more days, the pots were moved to a greenhouse bench. At that time, aluminum foil was wrapped around the base of the shoots for 2 inches to exclude light and the shoots were grown on the bench for 1 week before cuttings were taken. The cuttings were about 8 inches long with three to four fully expanded leaves. These leaves were cut back to half their original area, and the basal end was treated with 0.8% IBA-talc dip and placed in 6-9 inch clay pots. An intermittent mist was used.

Duncan and Matthews (2) reported success in rooting cuttings from 32-year-old southern red oak and 22-year-old water oak. They took cuttings 6-8 inches long collected June 7 and 8, after the leaves had matured and the wood had hardened off. The leaves were cut in half, a 1-inch slit was made on each side of the basal portion, and the basal area was treated with 0.8% IBA-talc dip. The cuttings were then placed in a propagation bed with mist system that operated for 5 seconds every 2 minutes during daylight for 5 weeks, then 5 seconds every 3 1/2 minutes during the day until September.

Most propagators I have talked with feel that to get the best rooting results you must keep the rooting medium warm (about 70°F) and the tops cool, with plenty of moisture available so no wilting will occur. The more sunlight the better, if the air temperature does not go too high.

These are not the only methods that can be used for asexual propagation of hardwoods, but they have given a good degree of success.

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